

_____ **Research Report** _____

**Rates of Reported Sexually
Transmitted Infections since
Admission to Canadian Federal
Prison and Associated
Incarceration Characteristics and
Sexual Risk-Behaviours**

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**Rates of Reported Sexually Transmitted Infections since Admission to Canadian Federal
Prison and Associated Incarceration Characteristics and Sexual Risk-Behaviours**

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Executive Summary

Key words: *risky sexual behaviour, exchange-sex, unprotected casual sex, sex with a partner of the same sex, sexually transmitted infections (STI), STI rates, inmate survey*

Previous research indicates that Canadian federal inmates, particularly women, are a high-risk group for sexually transmitted infections (STIs), but information about incarceration characteristics and sexual behaviours most strongly associated with these infections in correctional systems is sparse. To address this and other deficiencies in the literature, in 2007 the Correctional Service of Canada (CSC) conducted the National Inmate Infectious Diseases and Risk Behaviours Survey (NIIDRBS), a self-administered paper questionnaire completed by a large sample of Canadian federal inmates ($n = 3,370$). This report presents NIIDRBS data on the rate of reported STIs since admission to Canadian federal prison. Further, it examines associations between reporting an STI since admission and several incarceration characteristics and sexual behaviours.

The overall rate of at least one reported STI since admission to federal prison was 158 per 10,000 person-years served. Comparisons across sub-groups revealed elevated rates in women and Aboriginal males. Specifically, the rate of reporting an STI since admission was 4.5 times greater in women than men (669 vs. 150 per 10,000 person-years) and 1.6 times greater in Aboriginal males than non-Aboriginal males (222 vs. 136 per 10,000 person-years).

Among men, several incarceration characteristics and in-prison sexual behaviours were associated with reporting an STI since admission to federal prison. First, the odds of reporting an STI were about two times greater among males in maximum security compared to males in minimum security. Second, after serving a total of eight years cumulatively, the odds of reporting an STI among males appeared to consistently increase over time, plateauing after 14 years. After serving more than 16 years, the odds of reporting an STI had increased by a factor of 1.8 relative to those serving two years or less. Last, the odds of reporting an STI were approximately five times greater among males reporting exchange-sex (i.e., a transaction involving the exchange of sex for money, works, rigs, drugs or goods) compared to those who did not. Only 1.8% of the male population, however, reported this high-risk activity during the past six months in prison. Among recently sexually active women, reporting an STI since admission was associated with only one in-prison sexual behaviour. Specifically, those reporting an STI since admission were 1.6 times more likely to have unprotected sex with a casual partner than those not reporting an STI (56% vs. 35%).

With respect to community sexual behaviours, only one remained significantly associated with reporting an STI since admission among men: the odds of reporting an STI were about 3.4 times greater among those reporting sex with males compared to those who did not. Among women, several sexual behaviours in the community were significantly associated with reporting an STI since admission. First, the odds of reporting an STI were approximately three times greater in those reporting sex with females compared to those who did not. Second, the odds of reporting an STI were approximately 2.4 times greater among those being paid for sex compared to those who were not. Last, the odds of reporting an STI were 85% lower among those reporting

unprotected sex with a regular partner compared to those who did not. This last finding is counterintuitive. Unprotected sex is generally considered a risk-factor for STIs but our finding indicates it is protective. Although further research is necessary to validate this finding, it does reinforce the importance of distinguishing between unprotected sex with casual partners and regular partners.

Presently, all of the identified sexual risk-behaviours are screened for in the intake health status assessment at CSC. Healthcare professionals can use this assessment to identify individuals at elevated risk for STIs while incarcerated and thus more likely to benefit from regular STI testing at CSC. Since cumulative time served and security level were also associated with an increased risk of reporting an STI since admission among men, education, screening and testing needs to continue beyond admission, particularly among high-risk subgroups, and access to harm-reduction items (i.e., condoms, dental dams, and lubricant) needs to be monitored across security levels.

The primary limitations of this research arise from the cross-sectional design of the NIIDRBS and its reliance on self-report. To overcome these limitations, it may be useful in future research to test all inmates using biosamples (e.g., urine tests) at admission and regular follow-ups to maximize the accuracy of estimating the date of infection and recalling risk-behaviours.

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Introduction

Adverse Health Consequences of Sexually Transmitted Infections (STI)

STIs can cause serious health and reproductive complications, such as cancer, central nervous system and cardiovascular system damage, blood infections, internal organ damage, arthritis, pelvic inflammatory disease, epididymitis, infertility, ectopic pregnancy, and maternal-infant transmission of the STI. Because STIs are commonly asymptomatic, they frequently go undetected and untreated. Consequently, transmission can unknowingly continue through unprotected sexual activity (Public Health Agency of Canada, 2007b, 2009, n.d.^c; Centers for Disease Control, 2005, 2006a, 2006b). Moreover, the risk of acquiring and transmitting human immunodeficiency virus (HIV) through sexual contact is increased in the presence of other STIs (Public Health Agency of Canada, 2007a, 2007b, 2009). Although HIV is an STI, the risk of self-reported HIV since admission to a federal penitentiary is addressed in another report (Zakaria, Thompson, & Borgatta, in press^a). Consequently, this report focuses on STIs apart from HIV.

Rates of STIs among the Canadian General Population and Canadian Federal Inmates

A comparison of recent STI surveillance data for the Canadian general population (Public Health Agency of Canada, n.d.^d) and Canadian federal inmates (Correctional Service of Canada, 2008) indicates a greater incidence rate of STIs among Canadian federal inmates (see Table 1). Table 1 also indicates that the inmate to general population differential is greater among females than males; and, that gender differentials are not consistent across the community and prison environments. Specifically, in Canadian federal prisons the rate of chlamydia, gonorrhoea and syphilis is consistently higher among women than men. In the Canadian general population, however, the rate of gonorrhoea and syphilis is greater among males than females.

Table 1:

Incidence Rate (per 100,000) of STIs in Canadian Federal Inmates and the Canadian General Population in 2004

STI	Males		Females		All	
	Canadian Federal Inmates	Canadian General Population	Canadian Federal Inmates	Canadian General Population	Canadian Federal Inmates	Canadian General Population
Chlamydia	380	125	1,230	257	400	192
Gonorrhoea	60	36	980	19	80	28
Syphilis	70	8	250	2	80	5

Note. Canadian federal inmate estimates were obtained from Correctional Service Canada’s Infectious Disease Surveillance System. Canadian general population estimates were obtained from the Public Health Agency of Canada’s Notifiable Diseases On-Line. STI = sexually transmitted infection.

Characteristics Associated with STIs in the General Population

Characteristics associated with an increased risk of STIs include:

- i) sexual contact with person(s) known to have an STI;
- ii) a new sexual partner or more than two sexual partners in the past year;
- iii) sole use of non-barrier methods of contraception;
- iv) unprotected oral, vaginal or anal sex;
- v) sex with blood exchange;
- vi) sharing sex toys;
- vii) being a sex worker;
- viii) being a client of a sex worker;
- ix) exchanging sex for money, drugs, shelter or food;
- x) street involvement or homelessness;
- xi) anonymous sexual partnering;
- xii) being a victim of sexual assault or abuse; and,
- xiii) a previous STI (Public Health Agency of Canada, 2008).

Incarceration Characteristics Associated with Sexual Behaviour

Research involving inmates has found associations between incarceration characteristics and sexual behaviour. American research found that men in maximum security had more sexual encounters with other men, a higher overall interest in sexuality (i.e., higher overall disposition

towards sexual stimuli), and a less homophobic attitude compared to men in minimum security (Garland, Morgan, & Beer, 2005). Similarly, Canadian research involving federal male inmates found that the proportion of men reporting sex with another inmate increased with security level from 3% in minimum to 7% in maximum. Further, among men reporting sex with another inmate, the proportion reporting condom use decreased from 51% in minimum security to 30% in maximum security (Price Waterhouse, 1996). Consequently, one might expect the risk of STIs to increase with security level.

The amount of time incarcerated may also be related to an inmate's sexual behaviour. If the acceptability of engaging in sex with fellow inmates increases with time incarcerated, one might expect sexual activity to increase with time served. Garland et al. (2005) found that having spent a greater total time incarcerated in combination with serving a longer current sentence or being in maximum security was associated with a greater sexual preference towards the same sex. Further, greater total time incarcerated was significantly associated with sexually identifying as homosexual. Total time served, however, was not associated with the number of sexual encounters with other men after adjusting for security level and length of current sentence (Garland et al., 2005). Similarly, in a maximum security correctional facility for men in the southern U.S., amount of time served was not associated with consensual sex with other men (i.e., kissing, touching, performing oral sex, receiving oral sex, performing anal sex or receiving anal sex) (Hensley, Tewksbury, & Wright, 2001). Thus, the impact of time incarcerated on the risk of STIs is less clear.

Rationale for Present Research

Previous research indicates that Canadian federal inmates, particularly women, are a high-risk group for STIs, but information about incarceration characteristics and sexual behaviours most strongly associated with these infections in correctional systems is sparse. To address these and other deficiencies in the literature, in 2007 the Correctional Service of Canada (CSC) conducted the National Inmate Infectious Diseases and Risk Behaviours Survey (NIIDRBS), a self-administered paper questionnaire completed by a large sample of Canadian federal inmates. The survey captured information on inmates' sociodemographics; incarceration characteristics; sexual behaviours in the community and while incarcerated; and, self-reported STIs since admission to CSC for their current sentence.

This report presents NIIDRBS data on the rate of self-reported STIs since admission to Canadian federal penitentiaries. Further, it examines associations between reporting an STI since admission and sociodemographics, sexual behaviour and incarceration characteristics. Such information informs future CSC health research, policy development and programming decisions by identifying high-risk sub-groups, and incarceration characteristics or sexual behaviours related to an increased risk of STIs.

Method

Development of Survey Instrument

To obtain the data to meet the study objectives, a project team drawn from several federal government departments¹ opted to use a self-administered paper and pencil questionnaire (Zakaria, Thompson, & Borgatta, in press^b) as the data collection instrument. Questionnaire development included consultations with inmates in five different penitentiaries, including a women's facility and an Aboriginal inmate group, through focus groups. To maximize comprehension, the questions did not exceed a Grade 8 literacy level. Further, inmates could choose between the English or French version of the questionnaire.

The final questionnaire was 50 pages long and took inmates approximately 45 to 55 minutes to complete. The questionnaire captured information on risk-behaviours associated with the spread of blood-borne and sexually transmitted infections; inmate testing and treatment for HIV and hepatitis C virus (HCV) infections; inmate knowledge of HIV and HCV; and, inmate awareness and use of health education and harm reduction programs.

Prior to data collection, Health Canada's Research Ethics Board reviewed and approved the survey methodology.

Measures

NIIDRBS sections relevant to this report included reported STIs since admission to federal prison, sexual behaviours, and incarceration characteristics.

Reported STIs since admission to Canadian federal prison

Inmates reported whether they were told they had each of several STIs (chlamydia, gonorrhoea, syphilis, genital herpes, genital warts, or other STI) since admission to prison for their current sentence. Response options included: yes, no, and don't know. To minimize misclassification, "don't know" was considered the equivalent of missing. Because inmates could not report multiple episodes of a specific STI (e.g., chlamydia), these variables indicate the presence or absence of at least one episode of the STI since admission.

¹ CSC Research Branch, CSC Public Health Branch, and the Public Health Agency of Canada HIV/AIDS Policy, Coordination and Programs Division and Community Acquired Infections Division.

An aggregate STI variable was derived from responses to the specific STI questions: inmates who responded “yes” to at least one of the STIs were assigned a value of “yes”; inmates responding “no” to each of the STIs were assigned a value of “no”; and, all other inmates were assigned a missing value.

Reported sexual behaviours

Inmates reported on the following sexual behaviours during the past six months in prison: any sex (oral, vaginal, or anal); multiple sex partners; unprotected sex with male partners; unprotected sex with female partners; unprotected sex with regular partners; unprotected sex with casual partners (i.e., someone you don’t know well); unprotected sex during private family visits; sex with a partner who has HIV, HCV, an STI or an unknown infection status; using a sex toy previously used by someone else; exchange-sex (i.e., a transaction involving the exchange of sex for money, works, rigs, drugs or goods); and, unwanted sex (i.e., forced oral, vaginal, or anal sex).

Inmates admitted within the past three years (n=1,985 or 59% of the full sample) also reported on most of the above sexual behaviours for the last six months in the community prior to starting their current sentence. Community questions were limited to inmates admitted within the past three years to optimize recall accuracy. Sexual behaviours not captured or irrelevant in the community included: unprotected sex with male partners; unprotected sex with female partners; unprotected sex during private family visits; and, using a sex toy previously used by someone else. For a detailed link between these sexual behaviours and the questionnaire, see Appendix A.

Incarceration characteristics

Incarceration characteristics examined included: security level, years served of current sentence, cumulative federal and provincial/territorial years served, and participation in unsupervised conditional releases during the past six months in prison.

Inmate security level was imputed using institutional security level. Consequently, security level is unknown for the majority of women residing in multi-level security institutions (99% of the female sample).

Each inmate’s years served of current sentence was derived from his/her reported

admission year and the survey completion year (2007). Inmates admitted within 2007 had a value of 0.25 years imputed, the approximate mid-point of potential values for a survey conducted in the middle of 2007.

Each inmate's cumulative federal and provincial/territorial years served was the sum of reported total years served in federal prison and provincial/territorial jail. Survey options for federal prison included "less than one year" or the actual total years and months (if one year or longer). Provincial/territorial jail options included "never been in provincial/territorial jail", "less than 1 year", or the actual total years and months (if one year or longer). For both federal prison and provincial/territorial jail, inmates reporting "less than 1 year" had a value of 0.5 years imputed (the mid-point of potential values).

Finally, inmates reported any unsupervised conditional releases (unescorted temporary absences, day paroles, full parole, and statutory release) during the past six months in prison.

Sampling

Survey design and sample size estimation

The sample frame was all inmates in federal penitentiaries, numbering approximately 13,749 just prior to the time of the survey (March, 2007). Excluded from the frame were inmates unable to understand, orally or in writing, English or French (less than 0.5% of the inmate population). Each penitentiary served as a stratum, the size of which varied from stratum to stratum. For each male penitentiary, a sample size was calculated to ensure estimated proportions had a small margin of error ($\pm 5\%$), 8 times out of 10 [$\alpha = 0.20$ (two-tailed), $\sigma^2 = 0.25$, finite population correction factor applied] (Cochran, 1977, p. 75). If the estimated sample size for a specific institution was 80% or more of the institution's population, the whole population of the institution was invited to participate. This occurred with small penitentiary populations so the extra survey cost was minimal. Given the small number ($N = 479$) of women inmates, all were invited to participate. The final sample size estimate for the entire federal population, including both men and women, was 4,981 inmates.

Institutional sample lists

For each male penitentiary, simple random sampling without replacement from the sample frame generated a primary list. Two or more replacement lists (secondary lists) helped

maintain required sample sizes in the event an inmate refused to participate in the study or was not in the institution. Lists sorted by Aboriginal self-identification, primary official language (English or French), and aggregate sentence length facilitated substitutions. If an inmate on the primary list declined to participate or was not in the penitentiary for any reason, another inmate from the secondary list with the same characteristics could substitute for the originally sampled inmate.

Survey Implementation

Selection and training of survey coordinators

Regional (Atlantic, Quebec, Ontario, Prairies, and Pacific) survey coordinators were nominated by the Assistant Deputy Commissioners for Institutional Operations. In addition, each institution's warden nominated an institutional survey coordinator. Regional coordinators acted as liaisons with institutional coordinators and held weekly teleconferences with the Research Branch to resolve logistical issues during survey implementation. The Research Branch prepared an extensive survey training manual for the coordinators and conducted face-to-face training sessions to encourage survey ownership and standardize approaches and messaging.

Promoting awareness of the survey

Regional Management Committees, wardens, security staff and unions were briefed regarding the survey and indicated their support. To raise awareness in institutions about the survey, a general communication and frequently asked questions were sent to all CSC employees, and posters announcing the survey were posted in all institutions (Zakaria et al., in press^b). These posters emphasized the voluntary nature of the survey; guaranteed participants anonymity and confidentiality; and, reinforced that the overall purpose of the survey was to improve inmate health. Wardens also assisted by informing institutional management committees, inmate committees and local unions.

Inmate recruitment

Institutional coordinators received lists of eligible inmates two to three weeks prior to the scheduled data collection period. Before inmates were approached, both primary and secondary lists were reviewed by an institution's Warden or his/her designate to identify security risks.

Inmates deemed security risks were either excluded from further consideration or remained eligible to complete the questionnaire in their cell.

Institutional survey coordinators invited inmates on the sample list to participate in the study and to sign a consent form if they agreed (Zakaria et al., in press^b). For efficiency, group information sessions were organized with eligible inmates to describe the survey and review the consent form. Consent, however, was not obtained in a group setting but privately from each inmate. Inmates in segregation were recruited individually. Educational attainment information and experiences interacting with an inmate were used to decide whether to ask an inmate if he/she would like assistance completing the questionnaire. A small version (13.9 cm by 21.6 cm) of the survey poster was left with each inmate approached for participation (Zakaria et al., in press^b).

After scheduling was complete, CSC Security reviewed the list of inmates scheduled to complete the survey in a group setting to ensure compatibility among inmates scheduled for the same group session. Thereafter, each inmate was informed of when and where they were to complete the questionnaire and were reminded the day before. Recruitment activities continued, as necessary, until the end of the data collection period for a specific institution. This allowed replacement of inmates who were unable to complete the questionnaire for any reason.

Data collection

From May 22 to July 6, 2007, a private firm administered the questionnaire in each institution to those inmates with a signed consent form. The survey coordinator was responsible for organizing inmates for the day and time the survey contractor arrived to distribute questionnaires. Since the contractor did not have the sample list and inmates were specifically instructed not to put their name or the name of anyone else on the questionnaire, it was impossible to link the consent form with the completed questionnaire. In this manner, inmates could be assured of their anonymity and confidentiality.

Each inmate completed a self-administered questionnaire: behind a privacy screen when completed in a group setting; in his/her cell if in segregation; or through private one-on-one interviews if an inmate requested assistance. All participating inmates received the answers to the questionnaire's HIV and HCV knowledge questions after data collection was complete within their institution (Zakaria et al., in press^b).

Several factors limit inmate recruitment and survey completion in the correctional environment including the transfer of inmates between institutions, the departure of inmates at warrant expiry, and inmates on conditional leave during the survey period. In total, 3,370 inmates (3,006 men, 351 women, 13 transgendered) completed a questionnaire. Operational issues limited the majority of facilities from maintaining detailed records of the total number of inmates asked to participate; however, 13 institutions, accounting for approximately 27% of the total federal inmate population at the time of the survey, provided adequate detail to estimate a survey consent and response rate. Across these 13 institutions, which included inmates residing in minimum to maximum security levels, 1,687 inmates were asked to participate, 996 consented (consent rate = 59%) and 811 completed a questionnaire (response rate = 48%). In comparison, the 1995 National Inmate Survey reported a response rate of 64.2% [response rate = number who completed a questionnaire/(number who completed a questionnaire + number who refused)]. If inmate illnesses, releases, and transfers are included in the denominator, however, the response rate declines to 59.7% (Price Waterhouse, 1996, derived from Exhibit 1.3 on p.12). The difference in the response rates across the two surveys could be due to several factors, such as a change in the inmate profile over time or the greater sensitive content of the NIIDRBS.

The contractor retained all completed questionnaires and provided a database of anonymous survey records in August 2007. Preliminary analyses to test the integrity of the data were conducted in the fall and winter of 2007/08. The contractor destroyed all completed questionnaires in June 2008 after all data integrity issues were resolved.

General Analytical Approach

Statistical procedures for complex sample surveys

Typically, statistical procedures assume data were obtained through a simple random sample. Under such circumstances each inmate in the sample represents one inmate from the population and estimates derived from the sample relate to the population. In the NIIDRBS, inmates were randomly selected, but the sampling fraction was not consistent across institutions ranging from approximately 8% to 94%. Consequently, each inmate in the sample represented anywhere from about 1 to 13 inmates. Analyzing the NIIDRBS data as if it were obtained through simple random sampling (i.e., each inmate in the sample represents one inmate in the population) would produce incorrect population estimates and variances (Lee & Forthofer,

2006). All statistical estimates shown in this report acknowledge the NIIDRBS' complex sample design by incorporating weights that convey the number of inmates in the population represented by each inmate in the sample. The inverse of the institution's sampling fraction formed the weight for a record. Thus, estimates presented in this report relate to the Canadian federal inmate population. In addition, provision of estimated population sizes in the tables allows derivation of the number of inmates reporting a specific characteristic. Such information is of administrative value.

All analyses used SAS[®] 9.1 or 9.2 survey procedures (SAS Institute Inc., 2004, 2008) that take the complex sampling design into account. Inferences to the population use common decision criteria (e.g., two-tailed alpha of 0.05). To calculate the variance of an estimate, Taylor series (linearization)² was used with the finite population correction factor. Each point estimate reported here comes with a two-sided 95% confidence interval using either the Student's t-distribution or standard normal distribution. During bivariate analyses, we used the Rao-Scott chi-square test³ for association if the data were categorical and the Wald F statistic⁴ for continuous data.

Question non-response and small subpopulations

Question non-response is a limitation of most self-report surveys that probe personal or private matters such as sexual behaviour. Although sophisticated procedures exist for addressing low response rates on certain questions, this report used an approach similar to other studies found in the survey literature: on any given question we assume that non-responders and responders share similar characteristics. Tables shown in the report note those analyses using questions where the item non-response rate varied between 20% and 50% (based on the weighted distribution) to alert the reader to this issue. Furthermore, when item non-response exceeded 50%, we chose to suppress the reporting of estimates. For reasons of confidentiality and privacy, we do not report estimates where there are fewer than five inmates sharing a characteristic. Finally, due to their small number (n=13), results for the transgendered are not presented in this report.

² See SAS Institute Inc. (2004, p. 166) for details and related references.

³ See SAS Institute Inc. (2004, p. 4216) for details and related references.

⁴ See SAS Institute Inc. (2008, p. 6558) for details.

Specific Analyses

Degree to which the sample is representative of the population

To evaluate the extent to which the sample is representative of the inmate population, we compared sample estimates of sociodemographic and incarceration characteristics with estimates obtained from Canadian federal inmate administrative data.

Rates of reported STIs since admission to Canadian federal prison

For each specific STI and subgroup of interest, the rate is the weighted sum of reported cases relative to the weighted sum of years served of the current sentence or “person-years at risk”. “Person-years at risk” is a measurement combining persons and time, used as a denominator in rates. It is the sum of the individual units of time that the persons in a population have been followed (Last, 1995). As examples, one person followed for one year contributes one person-year; 100 people followed for one year contribute 100 person-years; and, 100 people followed for 0.5 years contribute 50 person-years. Using person-years to derive rates allows more valid comparisons across groups followed for differing periods of time.

$$\text{Rate} = \frac{\sum_{i=1}^n (w_i)(STI_i)}{\sum_{i=1}^n (w_i)(\text{years served of current sentence}_i)}$$

- w_i weight assigned to an inmate’s record
 STI_i 0 indicates no STI since admission
1 indicates at least one STI since admission
 n number of inmates in subgroup of interest

To contribute to a specific STI rate (i.e., chlamydia, gonorrhoea, syphilis, genital herpes, genital warts, other STI, or any STI), an inmate required complete information on both the presence/absence of the specific STI and the years served of current sentence. Subgroup-specific rates required additional information regarding gender and Aboriginal self-identification.

Estimates are presented for all inmates, separately for men and women, and by Aboriginal self-identification for each gender. An examination of reported STI rates by gender and Aboriginal self-identification allows CSC to respond to the unique needs of women and Aboriginal inmates. Since SAS[®] 9.2 is not presently capable of generating subgroup rates, these analyses were performed using a SAS macro (available at <http://support.sas.com/kb/25/033.html>). The t-test was used to assess differences in rates.

All rates are expressed per 10,000 person-years. These rates can be interpreted as the number of inmates reporting at least one STI episode among 10,000 inmates followed for one year.

Incarceration characteristics and in-prison sexual behaviours associated with reported STI since admission to Canadian federal prison

To identify associations, incarceration characteristics and in-prison sexual behaviours were compared between those reporting an STI since admission and those who did not. These analyses are presented for all inmates and separately for men and women.

Logistic regression of reported STI since admission on incarceration characteristics and in-prison sexual behaviours for Canadian federal inmates

To obtain estimates of the relative importance of incarceration characteristics and in-prison sexual behaviours associated with reporting an STI since admission, logistic regression was used. All variables significantly associated with reporting an STI since admission in bivariate analyses were placed in the logistic regression model. If the overall likelihood ratio test for the full model was statistically significant, the linearity assumption for statistically significant continuous variables (e.g., years served of current sentence or cumulative federal and provincial/territorial years served) was assessed using graphing and statistical methods. Briefly, a second model was produced by replacing the continuous variable with a categorical variable; the widths of intervals being decided by the data distribution and interpretability of regression coefficients. If the second model was statistically significant, the regression coefficients of the categorical variable were graphed relative to the mid-points of the categories to visually assess linearity of the logit of STI risk. Statistically, the partial likelihood ratio test was used to determine if the two models significantly differed. If the graph suggested linearity and the

models did not significantly differ, the model with the continuous variable was retained as the best model. Otherwise, the model incorporating the categorical variable was retained. This method of assessing linearity is detailed by Hosmer and Lemeshow (2000, p. 99-100).

The Wald chi-square test was used to assess the statistical significance of variables in the model, and the generalized coefficient of determination provided an estimate of the proportion of variation explained by the model (Nagelkerke, 1991). When interpreting generalized coefficients of determination, Hosmer and Lemeshow (2000, p.164) caution that low values are typical in logistic regression and do not necessarily reflect a bad model.

Community sexual behaviours associated with reported STI since admission to Canadian federal prison

Because STIs diagnosed in prison may be acquired in the community, sexual behaviours during the last six months in the community, prior to starting the current sentence, were also examined. To identify associations, community sexual behaviours were compared between those reporting an STI since admission and those who did not. These analyses are presented for all inmates and separately for men and women.

Logistic regression of reported STI since admission on community sexual behaviours for Canadian federal inmates

To obtain estimates of the relative importance of community sexual behaviours associated with reporting an STI since admission, logistic regression was used as previously described.

Results

Representativeness of the Sample and Population Characteristics

Canadian federal inmate population characteristics were comparable across data sources indicating the sample was representative of the population (see Appendix B). Based on the NIIDRBS, the majority of inmates were English speaking (78%, 95% CI: 77, 79), non-Aboriginal people (79%, 95% CI: 77, 80), born in Canada (89%, 95% CI: 88, 91), who had a high school diploma or greater at the time of the survey (54%, 95% CI: 52, 56), and were not in committed relationships (69%, 95% CI: 68, 71). Gender differences existed. On average, males were older (38 vs. 34 years, $F(1, 3192) = 106.64, p < 0.05$), had served a longer duration of their current sentence (4.8 vs. 2.2 years, $F(1, 2975) = 274.15, p < 0.05$), and were less likely to be Aboriginal (21% vs. 36%, $\chi^2(1, n = 3,234) = 94.37, p < 0.05$) compared to women.

Rates of Reported STIs since Admission to Canadian Federal Prison

The overall rate of an STI since admission to federal prison was 158 per 10,000 person-years (95% CI: 135, 181) (see Table 2). Put differently, if 10,000 inmates were followed for one year after admission, approximately 158 or 1.6% would report at least one STI.

With respect to specific STIs, rates were highest for genital warts (53 per 10,000 person-years, 95% CI: 39, 67), chlamydia (44 per 10,000 person-years, 95% CI: 32, 55), and genital herpes (44 per 10,000 person-years, 95% CI: 33, 56) (see Table 2).

Rates of reported STIs since admission by gender

The rate of an STI since admission to federal prison was 4.5 times greater among women than men (669 vs. 150 per 10,000 person-years, $t(3,315) = 7.89, p < 0.05$) (see Table 2). Similarly, for specific STIs, the female rates ranged from 2.7 to 9.6 times greater than the male rates.

Table 2:
Rate of Reported STIs since Admission among Canadian Federal Inmates

STI	n ^a	Number of Cases	Men (n=3,006) (N=13,222)		n	Women (n=351) (N=479)		t (3315)	n	All (n=3,357) (N=13,701)			
			Total Person-Years	Rate ^b (95% CI)		Number of Cases	Total Person-Years			Rate (95% CI)	Number of Cases	Total Person-Years	Rate (95% CI)
Chlamydia	2,364	200.63	50,305.26	40 [¶] (28, 51)	274	21.77	803.41	271 [¶] (194, 348)	5.85*	2,638	222.40	51,108.67	44 [¶] (32, 55)
Gonorrhoea	2,356	60.81	50,253.96	12 [¶] (7, 18)	272	9.35	810.09	115 [¶] (68, 163)	4.26*	2,628	70.16	51,064.05	14 [¶] (8, 19)
Syphilis	2,355	48.61	50,524.39	10 [¶] (5, 14)	269	‡	811.93	‡ [¶]		2,624	53.02	51,336.31	10 [¶] (6, 15)
Genital herpes	2,370	219.44	50,677.95	43 [¶] (32, 55)	270	9.35	805.02	116 [¶] (70, 162)	3.00*	2,640	228.79	51,482.97	44 [¶] (33, 56)
Genital warts	2,357	255.92	50,437.98	51 [¶] (36, 65)	272	16.05	803.31	200 [¶] (128, 272)	3.98*	2,629	271.97	51,241.29	53 [¶] (39, 67)
Other STI	2,348	161.34	50,381.87	32 [¶] (22, 42)	273	20.55	810.99	253 [¶] (180, 327)	5.85*	2,621	181.89	51,192.86	36 [¶] (25, 46)
Any STI	2,381	762.90	50,984.53	150 [¶] (127, 172)	283	55.97	836.45	669 (542, 796)	7.89*	2,664	818.87	51,820.98	158 [¶] (135, 181)

Note. STI = sexually transmitted infection; n = sample size; N = estimated population size.

^aindicates the number of inmates with specific STI and person-years of follow-up data. ^bexpressed per 10,000 person-years.

[¶]greater than 20% to 50% missing data (based on weighted distribution). [‡]suppressed because fewer than five inmates reported characteristic.

*p < 0.05.

Rates of reported STIs since admission by Aboriginal self-identification

Among men, the rate of an STI since admission to federal prison was approximately 1.6 times greater in Aboriginal than non-Aboriginal inmates (222 vs. 136 per 10,000 person-years, $t(3,315)=2.3$, $p<0.05$) (see Table 3). With respect to specific STIs, only the chlamydia rate significantly differed by Aboriginal self-identification: Aboriginal men were 4.4 times more likely than non-Aboriginal men to report at least one episode of chlamydia since admission to prison (106 vs. 24 per 10,000 person-years, $t(3,315) = 3.25$, $p <0.05$).

Among women, the rate of an STI since admission to federal prison did not significantly differ by Aboriginal self-identification (691 vs. 673 per 10,000 person-years, $t(3,315) = 0.13$, $p > 0.05$) (see Table 4). Non-Aboriginal women, however, had an “other STI” rate which was 1.9 times greater than that among Aboriginal women (332 vs. 172 per 10,000 person-years, $t(3,315) = 2.21$, $p<0.05$).

Table 3:

Rate of Reported STIs since Admission among Canadian Federal Male Inmates by Aboriginal Self-Identification

STI	n ^a	Non-Aboriginal Men (n=2,281) (N=10,480)			n	Aboriginal Men (n=612) (N=2,742)			t (3315)
		Number of Cases	Total Person-Years	Rate ^b (95% CI)		Number of Cases	Total Person-Years	Rate (95% CI)	
Chlamydia	1,859	98.37	40,428.10	24 (15, 33)	452	90.81	8,544.13	106 [¶] (58, 155)	3.25*
Gonorrhoea	1,854	34.87	40,418.20	9 (4, 13)	451	25.94	8,537.07	30 [¶] (7, 54)	1.80
Syphilis	1,856	38.77	40,704.88	10 (4, 15)	448	¶‡	8,520.81	¶‡	
Genital herpes	1,868	194.17	40,775.45	48 (34, 61)	450	25.27 [¶]	8,528.41	30 [¶] (5, 54)	1.26
Genital warts	1,852	176.42	40,538.82	43 (29, 58)	453	73.19	8,581.54	85 [¶] (37, 133)	1.64
Other STI	1,847	131.91	40,386.32	33 (21, 45)	450	29.43 [¶]	8633.68	34 [¶] (11, 57)	0.11
Any STI	1,877	558.42	40,987.94	136 (112, 160)	452	193.03	8,675.75	222 [¶] (153, 292)	2.30*

Note. STI = sexually transmitted infection; n = sample size; N = estimated population size.

^a indicates the number of inmates with specific STI and person-years of follow-up data.

^b expressed per 10,000 person-years.

[¶] greater than 20% to 50% missing data (based on weighted distribution). [‡] suppressed because fewer than five inmates reported characteristic.

* $p < 0.05$.

Table 4:

Rate of Reported STIs since Admission among Canadian Federal Women Inmates by Aboriginal Self-Identification

STI	n ^a	Non-Aboriginal Women (n=212) (N=309)			Aboriginal Women (n=129) (N=170)			t (3315)	
		Number of Cases	Total Person-Years	Rate ^b (95% CI)	n	Number of Cases	Total Person-Years		Rate (95% CI)
Chlamydia	170	10.57	416.98	253 [¶] (141, 366)	101	11.20	370.05	303 [¶] (193, 413)	0.62
Gonorrhoea	169	‡	418.86	¶‡	100	6.05	374.84	161 [¶] (92, 231)	
Syphilis	169	‡	418.86	¶‡	97	¶‡	376.68	¶‡	
Genital herpes	170	‡	424.74	¶‡	97	6.41 [¶]	363.90	176 [¶] (91, 261)	
Genital warts	170	7.74	420.33	184 [¶] (84, 284)	99	8.31	366.59	227 [¶] (117, 336)	0.57
Other STI	174	14.31	431.56	332 (213, 450)	96	6.24 [¶]	363.04	172 [¶] (94, 249)	2.21*
Any STI	175	29.68	429.68	691 (510, 871)	105	26.29	390.39	673 (490, 857)	0.13

Note. STI = sexually transmitted infection; n = sample size; N = estimated population size.

^aindicates the number of inmates with specific STI and person-years of follow-up data.

^bexpressed per 10,000 person-years.

[¶]greater than 20% to 50% missing data (based on weighted distribution).[‡]suppressed because fewer than five inmates reported characteristic.

*p < 0.05.

Incarceration Characteristics and In-Prison Sexual Behaviours Associated with Reported STI since Admission to Canadian Federal Prison

Incarceration characteristics

Among men, security level ($\chi^2(3, n = 2,515) = 14.00, p < 0.05$) and cumulative federal and provincial/territorial years served ($F(1, 2758) = 6.52, p < 0.05$) were significantly associated with reporting an STI since admission (see Table 5). With respect to security level, males reporting an STI were more likely to reside in maximum security facilities (29% vs. 19%) and less likely to reside in minimum security facilities (14% vs. 19%) compared to males not reporting an STI. In regards to years served, males reporting an STI since admission had served, on average, a greater number of years in federal and provincial/territorial institutions compared to males not reporting an STI (11.4 years vs. 9.6 years).

Since security level was unknown for the majority of women who resided in multi-level security institutions, the relationship between security level and reporting an STI since admission could not be examined. None of the remaining incarceration characteristics, however, were significantly associated with reporting an STI since admission among women.

Table 5:
Incarceration Characteristics by Reported STI since Admission to Canadian Federal Prison

	Men					Women					All				
	STI n=185 N=978		No STI n=2,330 N=12,244		χ (df) or F(v ₁ ,v ₂)	STI n=44 N=70		No STI n=256 N=410		χ (df) or F(v ₁ ,v ₂)	STI n=229 N=1,049		No STI n=2,586 N=12,653		χ (df) or F(v ₁ ,v ₂)
	n	Mean or % (95% CI)	n	Mean or % (95% CI)		n	Mean or % (95% CI)	n	Mean or % (95% CI)		n	Mean or % (95% CI)	n	Mean or % (95% CI)	
Security level (%)															
Maximum	52	29 (23, 35)	409	19 (19, 20)	14.00* (3)	-	-	-	-	-	-	-	-	-	-
Medium	85	57 (50, 63)	1144	60 (59, 61)		-	-	-	-	-	-	-	-	-	-
Minimum	46	14 (10, 17)	724	19 (19, 20)		-	-	-	-	-	-	-	-	-	-
Multiple	‡	‡	53	1 (1, 1)		-	-	-	-	-	-	-	-	-	-
Duration of incarceration															
Years served of current sentence	174	4.9 (4.2, 5.7)	2,207	4.8 (4.6, 5.1)	0.10 (1, 2616)	41	2.0 (1.6, 2.3)	242	2.1 (1.9, 2.4)	0.70 (1,2616)	215	4.7 (4.1, 5.4)	2,449	4.7 (4.5, 5.0)	0.00 (1,2616)
Cumulative federal and provincial/territorial years served	184	11.4 (10.1, 12.7)	2,324	9.6 (9.2, 9.9)	6.52* (1,2758)	43	4.9 (4.1,5.7)	253	4.4 (4.0, 4.9)	0.82 (1,2758)	227	10.9 (9.7, 12.2)	2,577	9.4 (9.0, 9.7)	5.41* (1,2758)
Conditional releases during past six months in prison (%)															
Any unsupervised release	24	13 (8, 17)	257	11 (9, 12)	0.43 (1)	11	24 (18, 30)	48	19 (16, 22)	2.04 (1)	35	13 (9, 18)	305	11 (10, 12)	0.82 (1)

Note. Subpopulations do not add to total due to rounding. Since security level is based on institutional security level, it is unknown for the majority of women residing in multi-level security institutions (99% of the female sample). STI = sexually transmitted infection; n = sample size; N = estimated population size.

‡suppressed because fewer than five inmates reported characteristic.

*p < 0.05.

In-prison sexual behaviours

Among men who were sexually active during the past six months in prison, reporting an STI since admission was associated with three in-prison sexual behaviours (see Table 6). Those reporting an STI since admission were less likely to report unprotected sex during private family visits (29% vs. 53%, $\chi^2(1, n = 374) = 7.22, p < 0.05$), more likely to report using someone else's sex-toy (16% vs. 5%, $\chi^2(1, n=313) = 4.15, p < 0.05$), and more likely to report exchange-sex (27% vs. 8%, $\chi^2(1, n = 337) = 8.64, p < 0.05$) than those not reporting an STI. As previously mentioned, exchange-sex is a transaction involving the exchange of sex for money, works, rigs, drugs or goods. This includes both "being paid for sex" and "paying for sex." These two risk-behaviours were combined because of small sample sizes.

Among women who were sexually active during the past six months in prison, reporting an STI since admission was associated with one in-prison sexual behaviour (see Table 6). Specifically, those reporting an STI since admission were 1.6 times more likely to report unprotected sex with a casual partner compared to those not reporting an STI (56% vs. 35%, $\chi^2(1, n = 77) = 5.11, p < 0.05$).

Table 6:
In-Prison Sexual Behaviours by Reported STI since Admission to Canadian Federal Prison

	Men					Women					All				
	STI n=185 N=978		No STI n=2,330 N=12,244		$\chi(1)$	STI n=44 N=70		No STI n=256 N=410		$\chi(1)$	STI n=229 N=1,049		No STI n=2,586 N=12,653		$\chi(1)$
Reported during the past six months in prison	n	% (95% CI)	n	% (95% CI)	$\chi(1)$	n	% (95% CI)	n	% (95% CI)	$\chi(1)$	n	% (95% CI)	n	% (95% CI)	$\chi(1)$
Any unwanted ^a sex (oral, vaginal, or anal)	§	§	§	§	-	§	§	§	§	-	§	§	§	§	-
Any sex	42	21 (15, 27)	363	16 (14, 17)	3.28	13	32 (24, 40)	68	28 (25, 31)	0.59	55	22 (17, 27)	431	16 (15, 17)	4.12*
Among sexually active inmates:															
Unprotected sex during private family visits ^b	12	29 (16, 42)	181	53 (48, 59)	7.22*	‡	‡	9	15 (9, 20)		12	26 (14, 38)	190	51 (46, 56)	8.93*
Unprotected sex with regular partner(s)	17	52 [¶] (35, 69)	151	55 [¶] (49, 61)	0.09	9	73 (61, 85)	39	59 (52, 66)	2.60	26	55 (40, 70)	190	56 [¶] (50, 61)	0.01
Unprotected sex with casual partner(s)	8	22 (8, 35)	42	17 [¶] (12, 22)	0.34	7	56 (41, 72)	23	35 (29, 42)	5.11*	15	26 (14, 38)	65	18 [¶] (14, 23)	1.13
Any unprotected sex	30	97 [¶] (92, 100)	303	98 (97, 100)	0.37	12	100	65	100	-	42	97 [¶] (93, 100)	368	99 (97, 100)	0.30
Sex with a partner who has HIV, HCV, an STI or an unknown infection status	9	31 [¶] (15, 46)	41	16 [¶] (11, 20)	3.62	6	43 (29, 58)	22	32 (26, 38)	1.72	15	32 (19,45)	63	17 [¶] (12, 21)	4.64*
Using a sex-toy previously used by someone else	5	16 [¶] (4, 28)	8	5 [¶] (2, 8)	4.15*	‡	‡	6	9 (5, 13)	0.71	7	16 [¶] (5, 26)	14	5 [¶] (2, 8)	4.52*
Any exchange-sex ^c	8	27 [¶] (12, 43)	26	8 (5, 11)	8.64*	‡	‡	‡	‡	-	9	25 [¶] (11, 39)	29	8 (5, 11)	8.31*
Sex with male(s)	§	§	§	§	-	§	§	§	§	-	§	§	§	§	§
Sex with female(s)	§	§	218	98 [¶] (96, 100)	-	12	100	52	100 [¶]	-	35	100 [¶]	270	98 [¶] (96, 100)	-
Among inmates having sex with female(s):															
Unprotected oral sex			143	76 (69, 82)	-	12	100	42	91 (86, 96)	-	22	69 (52, 85)	185	77 (71, 82)	0.71
Unprotected vaginal sex			157	76 (70, 82)	-	8	71 (58, 83)	32	73 (65, 81)	0.07	23	69 (52, 85)	189	76 (70, 81)	0.55
Unprotected anal sex			81	45 (37, 52)	-	5	47 (32, 63)	16	39 [¶] (30, 47)	0.72	11	36 (20, 53)	97	44 (37, 51)	0.52
sex with more than one female partner			33	22 [¶] (15, 29)	-	5	47 (30, 65)	18	39 (32, 47)	0.53	8	24 [¶] (10, 38)	51	23 [¶] (17, 29)	0.01

Note. Subpopulations do not add to total due to rounding. Among men reporting an STI since admission, sexual behaviour estimates specific to sex with females are suppressed due to missing data. The chi-square test is not calculable in the presence of zero cell counts. STI = sexually transmitted infection; HIV = human immunodeficiency virus; HCV = hepatitis C virus; n = sample size; N = estimated population size.

^aunwanted sex is forced sex. ^bprivate family visits provide inmates the opportunity to use separate facilities to meet privately with family. ^cexchange-sex is a transaction involving the exchange of sex for money, works, rigs, drugs or goods; it includes both “being paid for sex” and “paying for sex.”

[‡]suppressed because fewer than five inmates reported characteristic. [¶]greater than 20% to 50% missing data (based on weighted distribution). [§]suppressed because greater than 50% missing data (based on weighted distribution).

*p < 0.05.

Logistic regression of reported STI since admission on incarceration characteristics and in-prison sexual behaviours for Canadian federal inmates

Since women had only one in-prison sexual behaviour associated with reporting an STI since admission (i.e., unprotected sex with casual partners), logistic regression was limited to the men's data (see Table 7). Both statistical testing (partial likelihood ratio test ($df = 7, n = 2,296$) = 45.87, $p < 0.05$) and graphing (see Figure 1) indicated that cumulative federal and provincial/territorial years served should be modelled as a categorical variable rather than a continuous variable. In the logistic regression, three variables continued to be significantly associated with reporting an STI since admission: security level (Wald $\chi^2(3, n = 2,296) = 12.19$, $p < 0.05$), cumulative federal and provincial/territorial years served (Wald $\chi^2(8, n = 2,296) = 15.74$, $p < 0.05$), and exchange-sex during the past six months in prison (Wald $\chi^2(1, n = 2,296) = 15.66$, $p < 0.05$).

Security level

The odds of reporting an STI since admission were about two times greater among inmates residing in maximum security prisons compared to those residing in minimum security prisons, after adjusting for the other variables in the model (OR = 1.97, 95% CI: 1.29, 3.02, Wald $\chi^2(1, n = 2,296) = 9.75$, $p < 0.05$).

Cumulative federal and provincial/territorial years served

Relative to inmates serving two years or less, the odds of reporting an STI since admission fluctuated over the next 8 years served. Thereafter, the odds consistently increased, plateauing after 14 years. Only one of the "years served" categories significantly differed from the reference group: the odds of reporting an STI since admission were 1.8 times greater among those serving more than 16 years compared to those serving 2 years or less, after adjusting for the remaining variables in the model (OR = 1.77, 95% CI: 1.03, 3.03, Wald $\chi^2(1, n = 2,296) = 4.33$, $p < 0.05$).

Any exchange-sex during the past six months in prison

The odds of reporting an STI since admission were approximately five times greater among inmates reporting exchange-sex compared to those not reporting exchange-sex, after adjusting for the remaining variables in the model (OR = 4.99, 95% CI: 2.25, 11.07, Wald $\chi^2(1, n = 2,296) = 15.66$, $p < 0.05$).

Aboriginal self-identification

Because Aboriginal males had a higher rate of reported STIs since admission compared to non-Aboriginal males (see Table 3), Aboriginal self-identification was tested in the final model. Aboriginal self-identification was not independently associated with reporting an STI since admission, after adjusting for the remaining variables in the model (OR = 1.36, 95% CI: 0.89, 2.06, Wald $\chi^2(1, n = 2,248) = 2.03, p > 0.05$).

Table 7:
Logistic Regression of Reported STI since Admission on Incarceration Characteristics and In-Prison Sexual Behaviours for Canadian Federal Male Inmates

Characteristic	n=2,296 N=13,222 Odds Ratio (95% CI)	
	Security level	
Minimum (reference group)	1.00	1.00
Multiple	0.65 (0.19, 2.26)	0.65 (0.19, 2.26)
Medium	1.21 (0.83, 1.77)	1.17 (0.80, 1.73)
Maximum	2.01 (1.33, 3.05)*	1.97 (1.29, 3.02)*
Cumulative federal and provincial/territorial years served (continuous variable)		
Per 1 year increase	1.02 (1.01, 1.04)*	not in model
Cumulative federal and provincial/territorial years served (categorical variable)		
0 to 2 (reference group)	not in model	1.00
>2 to 4		1.54 (0.84, 2.81)
>4 to 6		0.63 (0.31, 1.28)
>6 to 8		1.79 (0.91, 3.51)
>8 to 10		1.15 (0.52, 2.54)
>10 to 12		1.41 (0.59, 3.36)
>12 to 14		1.73 (0.77, 3.87)
>14 to 16		2.21 (0.99, 4.91)
>16		1.77 (1.03, 3.03)*
Unprotected sex during private family visits^a during the past six months in prison		
No (reference group)	1.00	1.00
Yes	0.67 (0.32, 1.39)	0.64 (0.31, 1.33)
Using a sex-toy previously used by someone else during the past six months in prison		
No (reference group)	1.00	1.00
Yes	1.07 (0.29, 3.94)	1.13 (0.28, 4.54)
Any exchange-sex^b during the past six months in prison		
No (reference group)	1.00	1.00
Yes	4.63 (2.07, 10.38)*	4.99 (2.25, 11.07)*
	Model Fit Statistics	
Overall likelihood ratio test (df)	118.96 (7)*	164.83 (14)*
Coefficient of determination	0.0518	0.0712

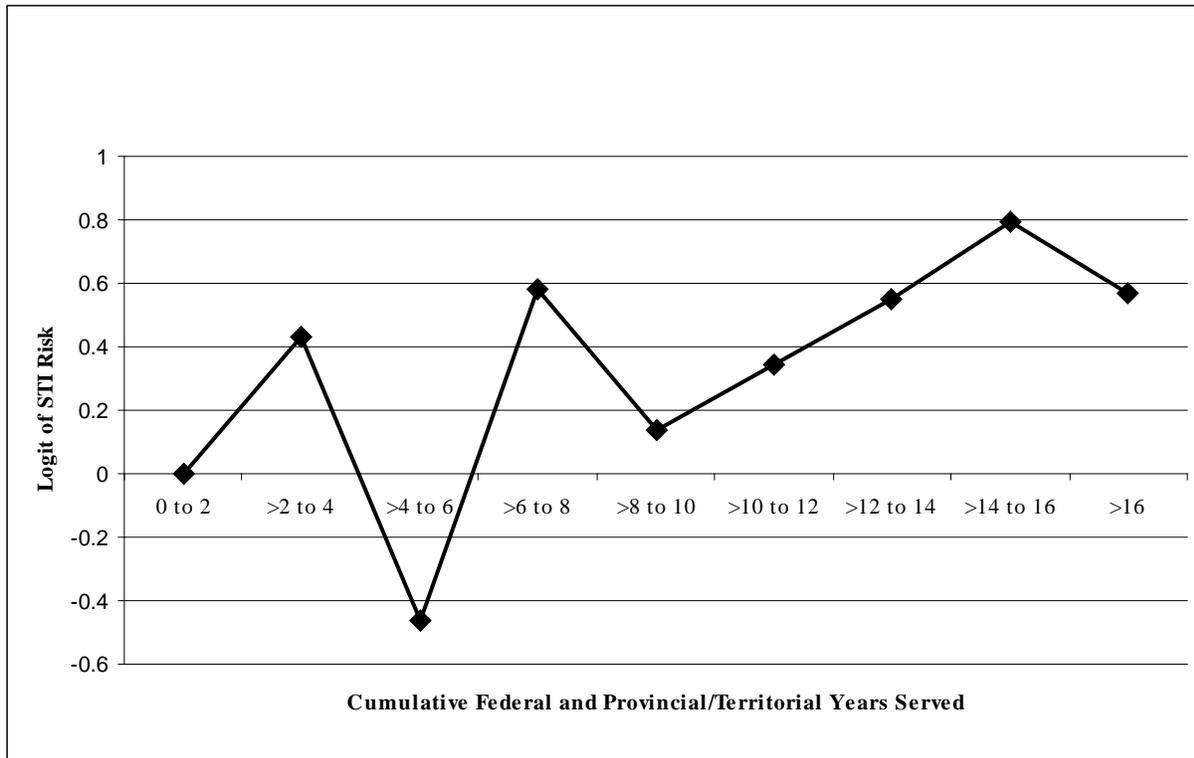
Note. The partial likelihood ratio test indicated that modelling cumulative federal and provincial/territorial years served as a categorical variable improved model fit [partial likelihood ratio test (df=7, n = 2,296) = 45.87, p < 0.05]. STI = sexually transmitted infection; n = sample size; N = estimated population size.

^aprivate family visits provide inmates the opportunity to use separate facilities to meet privately with family.

^bexchange-sex is a transaction involving the exchange of sex for money, works, rigs, drugs or goods.

*p < 0.05.

Figure 1. Logit of Reported STI Risk since Admission by Cumulative Federal/Provincial Time Served for Canadian Federal Male Inmates



Note. STI = sexually transmitted infection.

Community Sexual Behaviours Associated with Reported STI since Admission to Canadian Federal Prison

Among men, reporting an STI since admission was associated with three community sexual behaviours (see Table 8). Those reporting an STI since admission were more likely to report unwanted sex (7% vs. 2%, $\chi^2(1, n = 1,234) = 6.40, p < 0.05$) and any sex (94% vs. 83%, $\chi^2(1, n = 1,266) = 5.10, p < 0.05$) compared to those not reporting an STI. Further, among men who were sexually active during the last six months in the community, those reporting an STI since admission were three times more likely to report having sex with males compared to those not reporting an STI (15% vs. 5%, $\chi^2(1, n = 874) = 12.23, p < 0.05$).

Among women, reporting an STI since admission was associated with five community sexual behaviours (see Table 8). Those reporting an STI since admission were two times more likely to report unwanted sex compared to those not reporting an STI (29% vs. 14%, $\chi^2(1, n = 214) = 11.68, p < 0.05$). Further, among women who were sexually active during the last six months in the community, those reporting an STI since admission were less likely to report

unprotected sex with regular partners (70% vs. 90%, $\chi^2(1, n = 167) = 18.52, p < 0.05$) and any unprotected sex (83% vs. 93%, $\chi^2(1, n=167) = 6.02, p < 0.05$) compared to those not reporting an STI. Further, those reporting an STI were more likely to report being paid for sex (51% vs. 29%, $\chi^2(1, n = 167) = 14.09, p < 0.05$) and having sex with females (41% vs. 19%, $\chi^2(1, n = 163) = 16.41, p < 0.05$) compared to those not reporting an STI.

Table 8:
Community Sexual Behaviours by Reported STI since Admission to Canadian Federal Prison

	Men					Women					All				
	STI n=185 N=978		No STI n=2,330 N=12,244		χ (1)	STI n=44 N=70		No STI n=256 N=410		χ (1)	STI n=229 N=1,049		No STI n=2,586 N=12,653		χ (1)
Reported during the last six months in the community	n	% (95% CI)	n	% (95% CI)		n	% (95% CI)	n	% (95% CI)		n	% (95% CI)	n	% (95% CI)	
Any unwanted ^a sex (oral, vaginal, or anal)	6	7 (2, 12)	22	2 (1, 3)	6.40*	9	29 (20, 38)	25	14 (11, 16)	11.68*	15	9 (5, 14)	47	3 (2, 3)	15.15*
Any sex	76	94 (89, 99)	969	83 (81, 85)	5.10*	30	87 (80, 94)	151	82 (79, 85)	0.95	106	93 (88, 97)	1,120	83 (81, 85)	5.95*
Among sexually active inmates:															
Unprotected sex with regular partner(s)	61	86 (77, 95)	755	86 (83, 88)	0.00	21	70 (61, 79)	124	90 (86, 93)	18.52*	82	84 (76, 92)	879	86 (84, 88)	0.12
Unprotected sex with casual partner(s)	32	47 (35, 58)	343	39 (36, 42)	1.18	10	32 (24, 41)	43	31 (26, 35)	0.09	42	45 (35, 56)	386	39 (36, 42)	1.03
Any unprotected sex	65	92 (85, 100)	803	91 (89, 93)	0.08	25	83 (75, 90)	128	93 (90, 95)	6.02*	90	91 (85, 98)	931	91 (89, 93)	0.00
Sex with a partner who has HIV, HCV, or an unknown infection status	22	34 (23, 45)	193	23 (20, 25)	3.41	12	42 (33, 52)	52	37 (33, 42)	0.70	34	35 (25, 44)	245	23 (21, 26)	4.39*
Was paid for sex with "money, works, rigs, drugs, or goods (e.g. tobacco or cigarettes)"	7	9 (3, 15)	88	9 (7, 11)	0.01	15	51 (41, 60)	42	29 (25, 33)	14.09*	22	14 (8, 19)	130	10 (8, 12)	1.34
Paid for sex with "money, works, rigs, drugs, or goods (e.g. tobacco or cigarettes)"	13	15 (8, 23)	191	20 (18, 23)	1.04	‡	‡	8	6 (4, 8)	-	16	15 (8, 21)	199	20 (17, 22)	1.30
Sex with male(s)	11	15 (8, 23)	41	5 (3, 6)	12.23*	27	93 (89, 98)	122	88 (85, 92)	1.78	38	25 (17, 32)	163	9 (7, 10)	23.39*
Among inmates having sex with male(s):															
Sex with more than one male partner	8	69 (42, 95)	28	75 (61, 90)	0.17	20	74 (66, 83)	76	65 (60, 69)	2.46	28	71 (56, 87)	104	70 (63, 78)	0.01
Sex with female(s)	64	91 (84, 98)	858	96 (94, 97)	2.70	12	41 (32, 51)	26	19 (16, 23)	16.41*	76	86 (79, 92)	884	92 (91, 94)	4.99*
Among inmates having sex with female(s):															
Sex with more than one female partner	45	71 (59, 82)	563	68 (65, 71)	0.16	7	56 (43, 70)	14	55 (45, 66)	0.01	52	70 (59, 81)	577	68 (65, 71)	0.11

Note. Subpopulations do not add to total due to rounding. STI = sexually transmitted infection; HIV = human immunodeficiency virus; HCV = hepatitis C virus; n = sample size; N = estimated population size.

^aunwanted sex is forced sex.

‡suppressed because fewer than five inmates reported characteristic.

*p < 0.05.

Logistic regression of reported STI since admission on community sexual behaviours for Canadian federal inmates

In the logistic regression for men, one community sexual behaviour remained significantly associated with reporting an STI since admission: having sex with male partners during the last six months in the community (see Table 9). The odds of reporting an STI since admission were 3.4 times greater among those reporting sex with males compared to those who did not, after adjusting for the remaining variables in the model (95% CI: 1.63, 7.26, Wald $\chi^2 = (1, n=7942) = 10.50, p < 0.05$). Because Aboriginal males had a higher rate of reported STIs since admission compared to non-Aboriginal males (see Table 3), Aboriginal self-identification was tested in the final model. Aboriginal self-identification was not independently associated with reporting an STI since admission, after adjusting for the remaining variables in the model (OR = 1.38, 95% CI: 0.75, 2.57, Wald $\chi^2(1, n=1,050) = 1.06, p > 0.05$).

In the logistic regression for women, three community sexual behaviours remained significantly associated with reporting an STI since admission: unprotected sex with a regular partner, being paid for sex, and having sex with female partners (see Table 10).

Unprotected sex with a regular partner during the last six months in the community

The odds of reporting an STI since admission were 85% lower among those having unprotected sex with a regular partner compared to those who did not, after adjusting for the remaining variables in the model (OR = 0.15, 95% CI: 0.04, 0.60, Wald $\chi^2(1, n = 193) = 7.23, p < 0.05$).

Being paid for sex during the last six months in the community

The odds of reporting an STI since admission were 2.4 times greater among those who were paid for sex compared to those who were not, after adjusting for the remaining variables in the model (OR = 2.44, 95% CI: 1.21, 4.92, Wald $\chi^2(1, n = 193) = 6.16, p < 0.05$).

Sex with female partners during the last six months in the community

The odds of reporting an STI since admission were 2.9 times greater among those having sex with females compared to those who did not, after adjusting for the remaining variables in the model (OR = 2.94, 95% CI: 1.43, 6.04, Wald $\chi^2(1, n=193) = 8.56, p < 0.05$).

Table 9:
Logistic Regression of Reported STI since Admission on Community Sexual Behaviours for Canadian Federal Male Inmates

	n=1,072
	N=7,942
Reported during the Last Six Months in the Community	Odds Ratio (95% CI)
Any unwanted^a sex (oral, vaginal, or anal)	
No (reference group)	1.00
Yes	2.38 (0.85, 6.65)
Any sex	
No (reference group)	1.00
Yes	2.51 (0.95, 6.64)
Sex with male partner(s)	
No (reference group)	1.00
Yes	3.44 (1.63, 7.26)*
Model Fit Statistics	
Overall likelihood ratio test (df)	84.31 (3)*
Coefficient of determination	0.076

Note. STI = sexually transmitted infection; n = sample size; N = estimated population size.

^aunwanted sex is forced sex.

*p < 0.05.

Table 10:
Logistic Regression of Reported STI since Admission on Community Sexual Behaviours for Canadian Federal Women Inmates

	n=193
	N=391
Reported during the Last Six Months in the Community	Odds Ratio (95% CI)
Any unwanted^a sex (oral, vaginal, or anal)	
No (reference group)	1.00
Yes	1.82 (0.78, 4.24)
Unprotected sex with regular partner(s)	
No (reference group)	1.00
Yes	0.15 (0.04, 0.60)*
Any unprotected sex	
No (reference group)	1.00
Yes	2.81 (0.66, 11.87)
Was paid for sex with “money, works, rigs, drugs, or goods (e.g. tobacco or cigarettes)”	
No (reference group)	1.00
Yes	2.44 (1.21, 4.92)*
Sex with female partner(s)	
No (reference group)	1.00
Yes	2.94 (1.43, 6.04)*
Model Fit Statistics	
Overall likelihood ratio test (df)	25.11 (5)*
Coefficient of determination	0.1166

Note. STI = sexually transmitted infection; n = sample size; N = estimated population size.

^aunwanted sex is forced sex.

*p < 0.05.

Discussion

Rates of Reported STIs since Admission

The overall rate of at least one reported STI since admission to Canadian federal prison was 158 per 10,000 person-years served (see Table 2). Comparisons across sub-groups revealed differences by gender and Aboriginal self-identification. With respect to gender differences, the rate of reporting an STI since admission was about 4.5 times greater in women than men (669 vs. 150 per 10,000 person-years) (see Table 2). Similarly, for all specific STIs, rates among women were consistently greater than rates among men. Conversely, in the Canadian general population, gonorrhoea and syphilis incidence rates are actually greater in males than females. This gender difference among Canadian federal inmates and the disparity with the Canadian general population have been previously documented (see Table 1). In regards to differences by Aboriginal self-identification, the rate of reporting an STI since admission was approximately 1.6 times greater in Aboriginal males than non-Aboriginal males (222 vs. 136 per 10,000 person-years) (see Table 3). Examination of more specific STI rates among men revealed that chlamydia predominantly accounted for this disparity. Specifically, the rate of reported chlamydia since admission was more than 4 times greater among Aboriginal males than non-Aboriginal males (106 vs. 24 per 10,000 person-years). Caution should be exercised when interpreting these results. Although the suggestion is that women are a high-risk population for reporting an STI diagnosed since admission, other factors could account for the observed elevated risk. In particular, since the questionnaire did not enquire if inmates had been tested for STIs since admission, rates of STIs were calculated among all inmates (i.e., tested and not). If women are more rigorously targeted for testing or are more likely to seek testing at CSC, then they are more likely to have STIs diagnosed compared to men.

Comparisons of STI rates derived from the NIIDRBS with CSC surveillance rates and Canadian general population rates (see Table 1 and PHAC, 2009) are limited because of methodological differences. First, unlike previously published estimates, in this study, the number of episodes of a specific STI is limited to one for each inmate, and each inmate's actual time at risk is estimated as the years served of their current sentence. Although using "time-served" in the denominators of rates provides more accurate estimates of "time at risk," limiting the number of specific STI episodes reported by an inmate will have the impact of biasing rates

downward. Second, previously published estimates are based on the number of STIs diagnosed and reported while the NIIDRBS relied on self-report. Estimates based on self-report are vulnerable to recall and social desirability biases. The last methodological difference applies to comparisons between the Canadian general population and federal prison population. There are differences in the rigor of STI screening in these two populations. All inmates are offered voluntary screening and risk-based testing for STIs on admission. Moreover, testing is available upon request by an inmate at any time throughout his/her sentence (Correctional Service of Canada, 2008a, 2008b). Conversely, the Canadian general population must seek testing. These testing differences may be contributing to a spuriously large differential in STI rates between the Canadian general public and Canadian federal inmates.

Incarceration Characteristics and In-Prison Sexual Behaviours Associated with Reported STI since Admission to Canadian Federal Prison

Among recently sexually active women, reporting an STI since admission was associated with only one in-prison sexual behaviour: unprotected sex with casual partners during the past six months in prison. Those reporting an STI since admission were 1.6 times more likely to have unprotected sex with a casual partner than those not reporting an STI (56% vs. 35%) (see Table 6).

Among men, several incarceration characteristics and in-prison sexual behaviours were associated with reporting an STI since admission to federal prison (see Tables 6 and 7). Hence, logistic regression was used to determine their relative importance. Security level, cumulative federal and provincial/territorial years served, and exchange-sex during the past six months in prison all remained significantly associated with reporting an STI since admission (see Table 7).

Among men residing in maximum security, the odds of reporting an STI since admission were about twice that of men in minimum security. Previous American and Canadian research has found that men are more likely to report sex with other men in maximum security than in minimum security (Garland et al., 2005; Price Waterhouse, 1996). Furthermore, the 1995 Canadian federal inmate survey found that, among men having sex with other men, the proportion reporting condom use decreased from 51% in minimum security to 30% in maximum security (Price Waterhouse, 1996). Unfortunately, sex with male partners in prison could not be thoroughly evaluated using the NIIDRBS because of non-response.

After serving approximately eight years, the odds of reporting an STI among men appeared to consistently increase over time, plateauing after 14 years. Only those inmates serving more than 16 years, however, had odds of an STI which were significantly greater than those serving two years or less (OR = 1.77). Serving time is not a causal risk-factor for STIs, but it may be a surrogate for likelihood of exposure or magnitude of exposure to sexual risk-behaviours. More precisely, as an inmate serves more time, they may become more accepting of same-sex relationships and with additional time comes additional opportunity to engage in risky sexual behaviours.

Finally, the odds of reporting an STI were approximately five times greater among men reporting exchange-sex compared to those who did not. Only 1.8% of the male population, however, reported this high-risk activity during the past six months in prison.

Although Aboriginal self-identification was associated with the rate of reporting an STI since admission among men (see Table 3), it was not associated with reporting an STI in the male logistic regression. That is, the odds of reporting an STI were not significantly greater among Aboriginal men compared to non-Aboriginal men (OR = 1.36) after adjusting for incarceration characteristics and in-prison sexual behaviours.

Community Sexual Behaviours Associated with Reported STI since Admission to Canadian Federal Prison

Because STIs diagnosed in prison may be acquired in the community, the relationships between reporting an STI since admission to federal prison and sexual behaviours in the community were examined. In the logistic regression for men, only one community sexual behaviour remained significantly associated with reporting an STI since admission: sex with male partners during the last six months in the community (see Table 9). The odds of reporting an STI were about 3.4 times greater among those reporting sex with males compared to those who did not. Again, Aboriginal self-identification was not independently associated with reporting an STI since admission after adjusting for community sexual behaviours (OR = 1.38).

In the logistic regression for women, several sexual behaviours during the last six months in the community were significantly associated with reporting an STI since admission (see Table 10). First, the odds of reporting an STI were approximately three times greater in those reporting sex with females compared to those who did not. Second, the odds of reporting an STI were

approximately 2.4 times greater among those being paid for sex compared to those who were not. Last, the odds of reporting an STI were 85% lower among those reporting unprotected sex with a regular partner compared to those who did not. This last finding is counterintuitive. Unprotected sex is generally considered a risk-factor for STIs but our finding indicates it is protective. Although further research is necessary to validate this finding, it does reinforce the importance of distinguishing between unprotected sex with casual partners and unprotected sex with regular partners.

It is interesting that for both men and women, sex with a partner of the same sex was associated with greater odds of reporting an STI since admission compared to those not reporting this sexual behaviour. Additional research is necessary to determine the underlying reasons for this observed association. Potential reasons include an increased likelihood of continuing sex in the same-sex environment of prison and/or riskier sexual behaviour among those engaging in sex with a partner of the same sex.

Summary of Major Findings and Implications for CSC

The NIIDRBS indicates Canadian federal inmates report sexual risk-behaviours in both the community and, to a lesser extent, prison. Further, inmates report STIs while in prison. Consistent with previously established associations, our research found that involvement in exchange-sex and unprotected sex with casual partners were associated with an increased likelihood of reporting an STI since admission. Further, sex with a partner of the same sex in the community; and, among men, being in maximum security and cumulative time served were also associated with an increased likelihood of reporting an STI since admission.

These findings have implications for CSC. Presently, CSC's intake health status assessment screens for the following sexual behaviours: sex with a partner of the same sex; unprotected sex with regular and casual partners; ever being a sex trade worker; and, ever being a client of a sex trade worker. In addition to the usual education and recommendations for testing and treatment at admission, healthcare professionals can use affirmative responses to these questions to identify individuals at elevated risk for STIs while incarcerated and thus more likely to benefit from regular STI testing at CSC. In addition, the reasons why offenders choose to have unprotected sex can be explored in a non-judgemental fashion while educating inmates about the harm-reduction items (i.e., condoms, dental dams, and lubricant) CSC provides to prevent the

transmission of STIs (CSC, 2004).

Among women, sex with female partners in the community and unprotected sex with casual partners while incarcerated were associated with an increased likelihood of reporting an STI since admission. Although rates of STIs tend to be higher among heterosexual and bisexual women, STIs can be transmitted among women having sex exclusively with women (PHAC, 2008). Thus, STI testing recommendations for women who have sex with women should be based on a detailed risk assessment rather than assumptions of low-risk sexual behaviour. In addition, healthcare professionals need to dispel misconceptions regarding STI risk among women having sex with other women.

Among men, cumulative time served and security level were associated with an increased risk of reporting an STI since admission. Although additional research is needed to identify the underlying reasons these factors are related to STIs, the findings suggest that education, screening and testing needs to continue beyond admission, particularly among high-risk sub-groups, and that access to harm-reduction items needs to be monitored across security levels.

Limitations and Recommendations for Future Research

The NIIDRBS has several important limitations. First, since the NIIDRBS was a self-report survey, it is vulnerable to recall and social desirability bias. CSC, however, employed several strategies to optimize accuracy (e.g., an external private firm administered and retained the anonymous self-administered questionnaires). Second, since STIs may not have any signs or symptoms, some inmates in the “no STI” group may have undiagnosed STIs. This type of misclassification would tend to bias associations with reporting an STI towards the null; that is, true associations would be masked. Third, the questionnaire did not allow a distinction between STIs contracted in the community and prison. Hence, the actual rate of STIs resulting from in-prison sexual behaviour cannot be determined. Fourth, as previously mentioned, bias may have resulted from differences in the rigour with which subpopulations are tested for STIs, or from differences in the seeking of STI testing across subpopulations. Finally, a temporality issue exists when examining the associations between reporting an STI since admission and in-prison sexual behaviour. Specifically, behaviours were reported for the past six months in prison, not for the period prior to diagnosis with an STI. Thus, if inmates altered their behaviour because of an STI diagnosis, behaviours captured during the past six months in prison would not reflect pre-

diagnosis behaviours. Again, this would contribute to biased estimates of association.

Notwithstanding these limitations, which are common to self-report cross-sectional surveys, most of the factors identified as increasing the likelihood of reporting an STI since admission are consistent with previous research.

To overcome methodological limitations, it may be useful in future research to: test all inmates using biosamples (e.g. urine tests) instead of relying on self-report; test inmates at admission and regular follow-ups (e.g., every six months) to maximize accuracy in estimating the time of infection and recalling risk-behaviours; and, ask about risk-behaviours occurring since the last follow-up to minimize temporality issues. Finally, additional research is needed to delineate the factors underlying the observed associations between cumulative time served, security level, and STIs.

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Appendix A: Sexual Behaviours Captured by the NIIDRBS

Sexual Behaviours	NIIDRBS Questions	
	Prison	Community
Sexual Behaviours during the Past Six Months		
Any sex (oral, vaginal, or anal)	Q55	Q89
Sex with multiple partners	Q55a	Q90, Q90a, Q91, Q91a
Unprotected sex with male partners	Q57	-
Unprotected sex with female partners	Q56	-
Unprotected sex with regular partners	Q59	Q93
Unprotected sex with casual partners	Q60	Q94
Unprotected sex during private family visits	Q62, Q63	-
Having sex with a partner who has HIV, HCV, an STI, or an unknown infection status ^a	Q61	Q95
Using someone else's sex toy after they used it	Q58	-
Exchange-sex (i.e., a transaction involving the exchange of sex for money, works, rigs, drugs or goods)	Q65, Q66, Q67, Q68	Q96, Q97
Unwanted sex (i.e., forced oral, vaginal, or anal sex)	Q69	Q98

Note. To view the full questionnaire, see Zakaria et al. (in press^b). Some sexual behaviours were not captured or relevant in the community. NIIDRBS = National Inmate Infectious Diseases and Risk-Behaviours Survey; HIV = human immunodeficiency virus; HCV = hepatitis C virus; STI = sexually transmitted infection.

^aThe community question did not include STIs.

Appendix B: Canadian Federal Inmate Characteristics by Data Source

Characteristics	NIIDRBS (n=3,357) (N=13,701)				X ² (df) or F(v ₁ ,v ₂)	CSC Administrative Data (N=13,041)			
	Men (n=3,006) (N=13,222)		Women (n=351) (N=479)			Men (N=12,574)		Women (N=467)	
	n	Mean or % (95% CI)	n	Mean or % (95% CI)		N	Mean or %	N	Mean or %
Age (years)	2,899	38 (38, 39)	335	34 (34, 35)	106.64* (1,3192)	12,554	38	466	35
Highest level of education at time of survey (%)									
Less than highschool diploma	1,252	46 (44, 48)	156	48 (45, 51)	0.68	-	-	-	-
Highschool diploma or greater	1,533	54 (52, 56)	176	52 (49, 55)	(1)	-	-	-	-
Marital status (%)									
Married/common law	884	31 (29, 32)	121	35 (32, 38)	4.90*	4,839	39	165	36
Single/separated/divorced/widowed	2,043	69 (68, 71)	224	65 (62, 68)	(1)	7,654	61	297	64
Country of birth (%)									
Canada	2,622	89 (88, 90)	320	92 (91, 94)	5.87*	11,175	89	412	89
Other	305	11 (10, 12)	26	8 (6, 9)	(1)	1,386	11	53	11
Aboriginal self-identification (%)									
Aboriginal	612	21 (19, 22)	129	36 (33, 38)	94.37*	2,466	20	147	32
Non-Aboriginal	2,281	79 (78, 81)	212	65 (62, 67)	(1)	10,023	80	310	68
Race (%)									
White/caucasian	1,852	65 (63, 67)	179	55 (52, 58)	82.52*	8,482	68	258	56
Aboriginal	612	21 (20, 23)	129	36 (34, 38)	(2)	2,466	20	147	32
Other visible minority	356	14 (13, 15)	28	9 (7, 11)		1,541	12	52	11
Language most comfortable speaking (%)									
English	2,154	78 (77, 79)	302	84 (83, 86)	32.90*	8,425	74	317	79
French	719	20 (20, 21)	37	14 (13, 15)	(2)	2,342	21	62	15
Other	54	2 (1, 2)	6	2 (1, 2)		642	6	22	5
Years served of present sentence	2,702	4.8 (4.6, 5.1)	318	2.2 (2.0, 2.4)	274.15* (1, 2975)	12,554	4.4	466	3.0
Region (%)									
Atlantic	317	10 (10, 10)	50	13 (13, 13)	-	1,297	10	62	13
Quebec	868	24 (24, 24)	42	16 (16, 16)		2,990	24	73	16
Ontario	627	27 (27, 27)	84	26 (26, 26)		3,344	27	123	26
Prairie	847	25 (25, 25)	137	33 (33, 33)		3,168	25	151	32
Pacific	347	15 (14, 15)	38	13 (12, 13)		1,772	14	58	12
Security level (%)									
Maximum	581	21 (21, 21)	0		-	3,199	25	102	22
Medium	1,488	60 (60, 60)	0			6,934	55	196	42
Minimum	869	18 (18, 18)	4	1 (1, 1)		1,907	15	161	34
Unknown	68	1 (1, 1)	347	99 (99, 99)		534	4	8	2

Note. Percentages may not add to 100 due to rounding. Education level derived from administrative data is not comparable to NIIDRBS estimates because of inconsistency in method of capture (i.e., standardized testing at admission versus self-report at time of survey). Since NIIDRBS security level is based on institutional security level, it is unknown for the majority of women inmates residing in multi-level security institutions. The chi-square test was not calculable for region because of lack of stratum variance. NIIDRBS = National Inmate Infectious Diseases & Risk-Behaviours Survey; CSC = Correctional Service Canada; n = sample size; N = estimated population size.

*p < 0.05.